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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/672,346

09/26/2003

Joon-Seo Son

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7590

11/03/2005

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EXAMINER

IM, JUNGHWA M

ART UNIT

PAPER NUMBER

2811

DATE MAILED: 11/03/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	Application No.	Applicant(s)	
	10/672,346	SON ET AL.	
	Examiner	Art Unit	
	Junghwa M. Im	2811	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 18 August 2005.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 1-17, 19-23 and 25-27 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-17, 19-23 and 25-27 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |   |   |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)                        | 4) <input type="checkbox"/> Interview Summary (PTO-413)                     |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)    | Paper No(s)/Mail Date. _____  |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____   | 6) <input type="checkbox"/> Other: _____                                    |

## **DETAILED ACTION**

### ***Claim Rejections - 35 USC § 112***

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 14 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 14 recites a unclear limitation wherein “the first surface of the ceramic layer is directly attached to the second surface of the lead frame without using an adhesive.” It is pointed out that the instant invention discloses that the ceramic layer is bonded to the leadframe either by the molding material or by solder adhesive.

### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1, 3, 5, 25 and 27 are rejected under 35 U.S.C. 102(b) as being anticipated by Takahashi et al. (US 5783466), hereinafter Takahashi.

Regarding claim 1, Fig. 3B of Takahashi shows a discrete package comprising:

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a lead frame pad [32a] which has a first surface and a second surface, the second surface which is the opposite surface of the first surface;

leads [32] connected to a side of the lead frame pad;

a semiconductor chip [36] attached to the first surface of the lead frame pad;

a ceramic layer [31] having a first and second surface and which is positioned to directly contact the second surface of the lead frame pad; and

a molding material [39] which entirely encapsulates the lead frame pad, the semiconductor chip, and a portion of the ceramic layer, except the leads and the second surface of the ceramic layer.

Regarding claim 3, Fig. 3B of Takahashi shows the discrete package further comprising wires [38] which electrically connect the leads to the semiconductor chip.

Regarding claim 5, Fig. 3B of Takahashi shows the discrete package comprising an adhesive [37] between the lead frame pad and the semiconductor chip.

Regarding claim 25, Fig. 3B of Takabashi shows an electronics apparatus inherently made by a method comprising:

providing a packaged semiconductor device by providing a lead frame [32] having a first surface and a second surface with a lead connected to the lead frame,

attaching a semiconductor chip [36] attached to the first surface of the lead frame;  
attaching a first surface of a ceramic layer [31] to the second surface of the lead frame,

by encapsulating with a molding material [39] the lead frame the lead frame, the semiconductor chip, a portion of the lead, and the ceramic layer except for the second surface;

providing an outer heat sink [40]; and

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connecting the packaged semiconductor device to the outer heat sink.

Regarding claim 27, Fig. 3B of Takabashi shows wherein the first surface of the ceramic layer does not contain a conductive layer.

Claims 11-12 and 20-23 are rejected under 35 U.S.C. 102(b) as being anticipated by Wakefield (US 5598034).

Regarding claim 11, Fig. 1 of Wakefield shows a discrete package comprising:

a lead frame [11] having a first surface and a second surface with a lead connected to the lead frame;

a semiconductor chip [13] attached to the first surface of the lead frame;

a ceramic layer [10; col. 5, lines 18-33] having a first surface and a second surface, wherein the first surface of the ceramic layer is directly attached to the second surface of the lead frame; and

a molding material [14] which encapsulates the lead frame, the semiconductor chip, a portion of the lead, and the ceramic layer except for the second surface.

Regarding claim 12, Fig. 1 of Wakefield shows the first surface of the ceramic layer does not contain a conductive layer through being a ceramic substrate.

Regarding claim 20, Fig. 1 of Wakefield shows a packaged semiconductor device inherently made by a method comprising:

providing a lead frame [11] having a first surface and a second surface with a lead connected to the lead frame;

attaching a semiconductor chip [13] attached to the first surface of the lead frame;

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attaching a first surface of a ceramic layer [10; col. 5, lines 18-33] to the second surface of the lead frame, wherein the first surface of the ceramic does not contain a conductive layer and is attached to the second surface of the lead frame; and

encapsulating with a molding material [14] the lead frame the lead frame, the semiconductor chip, a portion of the lead, and the ceramic layer except for the second surface.

Regarding claim 21, Fig. 1 of Wakefield shows a packaged semiconductor device made with a method comprising directly attaching the first surface of the ceramic layer to the second surface of the lead frame.

Regarding claim 22, Fig. 1 of Wakefield shows a packaged semiconductor device made with a method wherein the encapsulation is performed using a molding material [14].

Regarding claim 23, it is inherent that Fig. 1 of Wakefield shows that the first surface of the ceramic layer does not contain a conductive layer.

### *Claim Rejections - 35 USC § 103*

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Takahashi in view of Wakefield.

Regarding claim 2, Fig. 3B of Takabashi shows substantially the entire claimed structure except “the leads are stepped with respect to the lead frame pad.” Fig. 1 of Wakefield shows the leads are stepped with respect to the lead frame pad.

It would have been obvious to one of ordinary skill in the art at the time of the invention was made to incorporate the teachings of Wakefield into the device of Takahashi in order to have the leads stepped with respect to the lead frame pad to accommodate the desired configuration of the device.

Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Takahashi in view of Nakanishi et al. (US 6501156), hereinafter Nakanishi.

Regarding claim 4, Fig. 3B of Takabashi shows substantially the entire claimed structure except “the lead frame pad is formed to a thickness of 0.5 mm.” Nakanishi discloses the lead frame pad with a thickness range of 0.5-0.7 mm.

It would have been obvious to one of ordinary skill in the art at the time of the invention was made to incorporate the teachings of Nakanishi into the device of Takabashi in order to have to the lead frame pad with a thickness of 0.5 mm to accommodate the manufacturing specification.

In addition, it would have been obvious to one of ordinary skill in the art at the time of the invention to have the lead frame pad with a thickness of 0.5 mm in order to meet the manufacturing specification, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

Claim 6-8, 10, 13-17, 19 and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wakefield (US 5598034) in view of Heinen et al. (US 5422788), hereinafter Heinen.

Regarding claim 6, Fig. 1 of Wakefield shows a discrete package comprising:

a lead frame pad [a center portion of the lead frame 11] which has a first surface and a second surface, the second surface which is the opposite surface of the first surface;

leads [11] which are connected to a side of the lead frame pad;

a semiconductor chip [13] which is attached to the first surface of the lead frame pad;

a ceramic layer [10; a ceramic heat sink; col. 5, lines 18-22] having a first and second surface and which is directly attached to the second surface of the lead frame pad via an adhesive; and

a molding material [14] which entirely encapsulates the lead frame pad, the semiconductor chip, and a portion of the ceramic layer, except the leads and the second surface of the ceramic layer.

Fig. 1 of Wakefield shows substantially the entire claimed structure except the adhesive being "an epoxy." Fig. 1 of Heinen shows the adhesive material between the heat sink and the a die pad being an epoxy (col. 2, lines 60-63).

It would have been obvious to one of ordinary skill in the art at the time of the invention was made to incorporate the teachings of Heinen into the device of Wakefield in order to use an epoxy adhesive to attach the device to the ceramic layer since the epoxy is well know and readily available adhesive.



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Regarding claim 7, Fig. 1 of Wakefield shows the leads are stepped with respect to the lead frame pad.

Regarding claim 8, Fig. 1 of Heinen shows wires [13] which electrically connect the leads to the semiconductor chip.

Regarding claim 10, Fig. 1 of Wakefield shows an adhesive [12] between the lead frame pad and the semiconductor chip.

Regarding claim 13, Fig. 1 of Wakefield shows substantially the entire claimed structure except “a ceramic layer is attached with the second surface of the lead frame pad by using the molding material.” Fig. 1 of Heinen shows a ceramic layer which is attached with the second surface of the lead frame pad by using the molding material (an epoxy; col. 2, lines 60-63).

It would have been obvious to one of ordinary skill in the art at the time of the invention was made to incorporate the teachings of Heinen into the device of Wakefield in order to use molding material to attach the ceramic layer to the lead frame since molding material is readily available adhesive.

Regarding claim 14, insofar as understood, Fig. 1 of Wakefield shows a discrete semiconductor package, comprising:

- a lead frame [11] having a first surface and a second surface with a lead connected to the lead frame;

- a semiconductor chip [13] attached to the first surface of the lead frame;

- a ceramic layer [10; a ceramic heat sink; col. 5, lines 18-22] having a first surface and a second surface, wherein the first surface of the ceramic layer is attached to the second surface of the lead frame via an adhesive; and

a molding material [14] which encapsulates the lead frame, the semiconductor chip, a portion of the lead, and an entire portion of the second surface [side surfaces] of the ceramic layer.

Fig. 1 of Wakefield shows substantially the entire claimed structure except the adhesive being "an epoxy." Fig. 1 of Heinen shows the adhesive material between the heat sink and the a die pad being an epoxy (col. 2, lines 60-63).

It would have been obvious to one of ordinary skill in the art at the time of the invention was made to incorporate the teachings of Heinen into the device of Wakefield in order to use an epoxy adhesive to attach the device to the ceramic layer since the epoxy is well know and readily available adhesive.

Regarding claim 15, Fig. 1 of Wakefield shows an electronic apparatus containing a packaged semiconductor device, the device comprising:

a lead frame [11] having a first surface and a second surface with a lead connected to the lead frame;

a semiconductor chip [13] attached to the first surface of the lead frame;

a ceramic layer having a first surface [10; col. 5, lines 18-33] and a second surface; and

a molding material [14] which encapsulates the lead frame, the semiconductor chip, a portion of the lead, and the ceramic layer except for the second surface wherein the ceramic layer is attached the lead frame.

Fig. 1 of Wakefield shows substantially the entire claimed structure except the adhesive being only a molding material. Fig. 1 of Heinen shows the adhesive material between the heat sink and the a die pad being an epoxy (a molding material) (col. 2, lines 60-63).

It would have been obvious to one of ordinary skill in the art at the time of the invention was made to incorporate the teachings of Heinen into the device of Wakefield in order to use a molding material (an epoxy adhesive) to attach the device to the ceramic layer since the epoxy is well know and readily available adhesive.

Regarding claim 16, Fig. 1 of Wakefield shows the first surface of the ceramic layer is directly attached to the second surface of the lead frame.

Regarding claim 17, it is obvious that Fig. 1 of Wakefield shows the first surface of the ceramic layer does not contain a conductive layer since an element 10 is a ceramic heat sink.

Regarding claim 19, Fig. 1 of Wakefield shows a packaged semiconductor device obviously made by a method comprising:

providing a lead frame [11] having a first surface and a second surface with a lead connected to the lead frame;

providing a semiconductor chip [13] attached to the first surface of the lead frame;

providing a ceramic layer [10; col. 5, lines 18-33] having a first surface and a second surface; and

providing a molding material [14] which encapsulates the lead frame, the semiconductor chip, a portion of the lead, and the ceramic layer except for the second surface.

Fig. 1 of Wakefield shows substantially the entire claimed structure except the adhesive being “a molding material.” Fig. 1 of Heinen shows the adhesive material between the heat sink and the a die pad being an epoxy (a molding material) (col. 2, lines 60-63).

It would have been obvious to one of ordinary skill in the art at the time of the invention was made to incorporate the teachings of Heinen into the device of Wakefield in order to use a

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molding material (an epoxy adhesive) to attach the device to the ceramic layer since the epoxy is well known and readily available adhesive.

Regarding claim 26, Fig. 1 of Wakefield shows wherein the first surface of the ceramic layer does not contain a conductive layer.

Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wakefield and Heinen as applied to claim 6 above, and further in view of Nakanishi.

Regarding claim 9, combined teachings of Wakefield and Heinen show substantially the entire claimed structure except “the lead frame pad is formed to a thickness of 0.5 mm.”

Nakanishi discloses the lead frame pad with a thickness range of 0.5-0.7 mm.

It would have been obvious to one of ordinary skill in the art at the time of the invention was made to incorporate the teachings of Nakanishi into the device of Wakefield and Heinen in order to have the lead frame pad with a thickness of 0.5 mm to accommodate the manufacturing specification.

In addition, it would have been obvious to one of ordinary skill in the art at the time of the invention to have the lead frame pad with a thickness of 0.5 mm in order to meet the manufacturing specification, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

### ***Response to Arguments***

Applicants' arguments filed August 18, 2005 have been fully considered but they are not persuasive. The rejection stands, modified only to accommodate the amendments made to the claims by Applicant. New rejections are made in response to Applicant amended claims. In addition, the examiner presents the remarks below in response to Applicant's arguments.

Applicants mainly argue that "The rejected claims currently contain the limitation that a ceramic layer is directly attached to the lead frame. ... Takahashi et al., however, describe a semiconductor device where a ceramic substrate 31 is connected to copper circuit pattern member 32 by using an alloy layer of 33 of ceramic and copper. See column 5, lines 7-10. Thus, the alloy layer 33 of Takahashi et al. is present between ceramic substrate and lead frame 32." Firstly, it is point out that the instant invention discloses that a ceramic layer is attached to the lead frame by using the molding material. See paragraph [0027] of US Pub 2004/0061206 (US PAT. PUB of the instant invention). The instant invention further substantiates this aspect through the recitation in claim 6 or in claims 15 and 16. for example, claim 6 recites that "a ceramic layer ... is directly attached to ... the lead frame ... via an epoxy..." Or, independent claim 15 recites that "the ceramic layer is attached to the lead frame using only the molding material." Then claim 16 dependent on claim 15 recites that " ... the ceramic layer is directly attached to ... the lead frame." With this understanding, in the instant invention a ceramic layer is directly attached to the lead frame by molding material while in the Takahashi's device by an alloy of ceramic and copper. Note that Takahashi discloses that "An alloy layer 33 of ceramic and copper is formed between the ceramic substrate 31 and copper ... member 32 to fix the ...member 32 onto the substrate 31." Therefore, there is no structural difference between the device of the instant invention and the device of Takahashi.

Regarding claim 6, Applicants argue that “described by Wakefield et al., the heat sink 10 is connected to the die pad 11 using an adhesive 12 or the like. The adhesive can be any suitable conductive or non-conductive adhesive. See column 4, lines 5-15. Thus, the skilled artisan would have understood that the device of Wakefield et al. uses an adhesive to attach the heat sink 10 and the die pad 11, unlike the claimed invention where the ceramic layer is directly attached to the lead frame or that the ceramic layer is attached to the lead frame by using only a molding material.” It is pointed out that Wakefield shows a structure substantially identical to the one recited in the instant invention except the adhesive being “an epoxy.” Even though an ordinary person skilled in the art readily understands that “non-conductive” adhesive disclosed in Wakefield is an epoxy, Heinen is further introduced merely to show that it is well known in the art an epoxy is used as an adhesive.

### *Conclusion*

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event,

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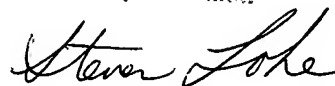
however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Junghwa M. Im whose telephone number is (571) 272-1655. The examiner can normally be reached on MON.-FRI. 8:30AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stephen Loke can be reached on (571) 272-1657. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

jmi

A handwritten signature in cursive script, reading "Stephen Loke".